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FLOOD INSURANCE STUDY

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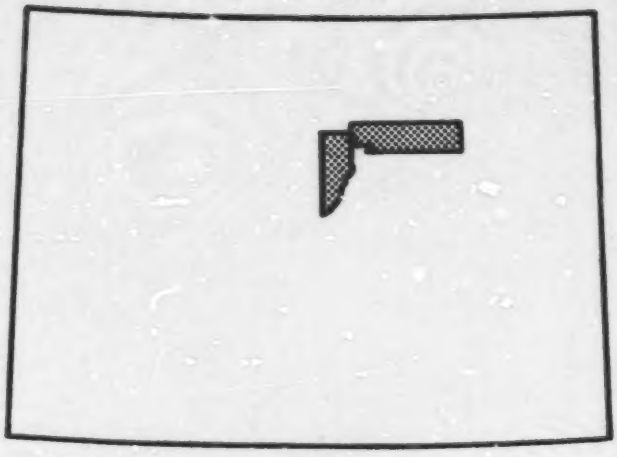
CITY OF WESTMINSTER, COLORADO

ADAMS AND JEFFERSON COUNTIES

VOLUME 1 OF 2



ORIGINAL

COMPLETED

SEPTEMBER 30, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 080008

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
CITY OF WESTMINSTER, ADAMS AND JEFFERSON COUNTIES, COLORADO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Westminster, Adams and Jefferson Counties, Colorado and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Greiner Engineering Sciences, Inc. of Denver, Colorado, for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-83-C-11-73. This study was completed in June 1985.

1.3 Coordination

An initial coordination meeting was held by the City of Westminster on April 25, 1983. This meeting, attended by representatives of the City of Westminster, Colorado Water Conservation Board, Urban Drainage and Flood Control District and the study contractor, was held to discuss the nature and purpose of the study and the scope and limits of work.

The following agencies and individuals were contacted and supplied information used in the preparation of this study:

Colorado Water Conservation Board (CWCB) - State Coordinator
City of Westminster Engineering Department
Colorado Urban Drainage and Flood Control District (UD&FCD)
Colorado Highway Department (CHD)
Soil Conservation Service (SCS)

On January 5, 1987, the results of the Flood Insurance Study were reviewed at a final coordination meeting atttended by representatives of the City of Westminster, UD&FCD, FEMA, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Westminster. The City is located in parts of Adams and Jefferson Counties in Colorado. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were identified to be studied by detailed methods:

Stream Name	Reach Description	Stream Miles
Big Dry Creek	Interstate 25 to Standley Lake	13.6
Walnut Creek	Mouth to Corporate Limits	3.1
City Park Channel	West 120th Ave. to Corporate Limits	0.9
South Branch Hylands Creek	Mouth to Sheridan Blvd.	1.2
Nissen Reservoir Channel	Mouth to Corporate Limits	0.4
Airport Creek	Mouth to U.S. 36	1.4
Ranch Creek	Mouth to Huron Ave.	2.1
Middle Branch Hylands Creek	Mouth to 104th Ave.	2.1
North Branch Walnut Creek	Mouth to Corporate Limits	0.6
Countryside Creek	Mouth to Oak St.	1.5
Tanglewood Creek	Mouth to 120th Ave.	1.8
Trib. "B" Little Dry Creek	Wadsworth Blvd. Upstream 2700 feet	0.5
South Branch Ranch Creek	Mouth to 112th Ave.	0.5
North Branch Hylands Creek	Mouth to 104th Ave.	1.2
Brandywine Creek	Mouth to Corporate Limits	0.1
Middle Cotton Creek	Mouth to Lowell Blvd.	1.0
North Cotton Creek	Mouth to Lowell Blvd.	0.7
South Cotton Creek	Mouth to 1,760 Feet Above Mouth	0.5
North City Park Creek	Mouth to 2,300 Feet Upstream Of Mouth	0.5
South City Park Creek	Mouth to Sheridan Blvd.	0.4

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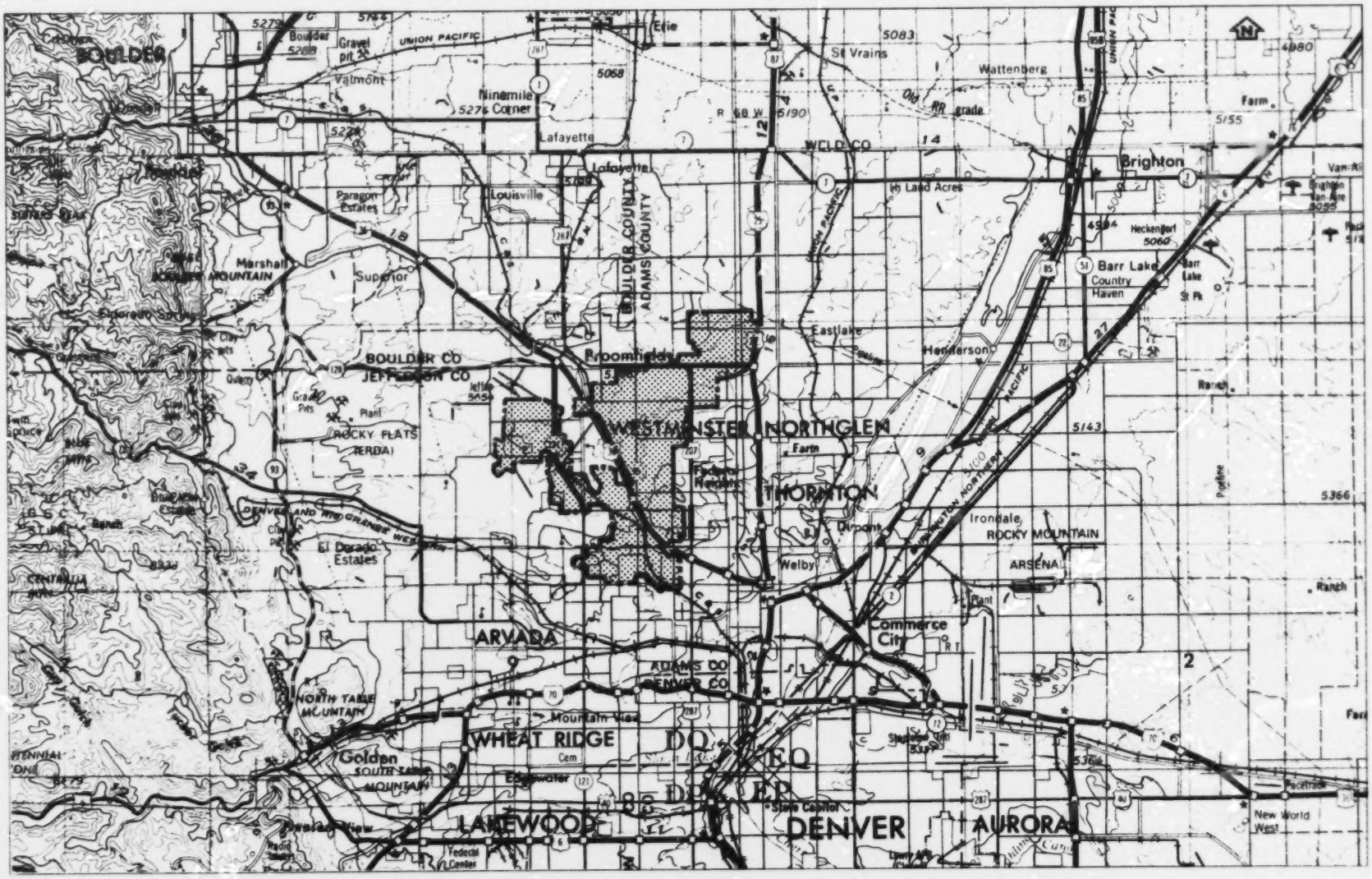

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER, CO
(ADAMS AND JEFFERSON COS.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

Technical data for flooding on City Park Channel, Nissen Reservoir Channel, and overflow from Brandywine Creek were taken from a report by the Colorado UD&FCD (Reference 1) and the Broomfield Colorado Flood Insurance Study (Reference 2).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1989.

Ketner Creek (Reference 3), Shaw Heights Tributary and Little Dry Creek (Reference 4), which were studied previously by the Colorado Urban Drainage and Flood Control District, were included as approximate study areas.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Westminster, Colorado.

2.2 Community Description

Westminster is located on the east slope of the Rocky Mountains, about 8 miles northwest of the State Capitol Building in Denver. In 1980, the population of Westminster was 50,211 (Reference 5). Continued growth is expected for the city.

Big Dry Creek has its source in the Rocky Flats area southwest of the City of Boulder, Colorado, and is a tributary to Standley Lake. Walnut Creek begins near the Rocky Flats Plant of the Atomic Energy Commission, and is a tributary to the Great Western Reservoir. Little Dry Creek originates just southwest of Standley Lake, passing through Arvada and Westminster to Clear Creek. Airport Creek has its source in the Jeffco Airport area. All of the other streams studied have their sources basically within the city limits, and have little or no flow most of the time.

The total drainage area of Big Dry Creek to Interstate 25 is 56.84 square miles, of which 16.75 square miles are above the two reservoirs. Watershed elevations range from approximately 6,500 feet at the headwaters of the drainage area of Standley Lake to 5,160 feet at Interstate 25.

The climate of the area has characteristic features of low relative humidity, low rainfall, moderate to high wind movement, and a large daily range in temperature. The annual average maximum and minimum temperatures are 60.2 and 39.1 degrees F. Recorded temperature extremes are a high of 102 degrees F. to a low of -26 degrees F. The average annual precipitation is 15.14 inches. Sixty nine percent of this precipitation falls during April through September. Summer precipitation is largely from thunderstorm activity and is sometimes extremely heavy.

Land use within the study area is mixed between commercial and residential, with several parks and open undeveloped areas.

2.3 Principal Flood Problems

The streams that flow into Standley Lake and Great Western Reservoir, along with Big Dry and Little Dry Creeks, are generally well defined with relatively narrow channels. The tributaries to Big Dry and Little Dry Creeks at time are not very well defined and are generally shallow with low banks. Industrial and residential developments already exist along portions of the streams, especially below the reservoirs.

Generally, the streams are intermittent, having little or no flow most of the time. Flooding in the Westminster area is caused by heavy local rainstorms. Flooding occurred in May 1973, especially in the vicinity of Big Dry Creek at Huron Street. No other record of flooding could be identified during the reconnaissance and library searches.

2.4 Flood Protection Measures

There are no flood protection works on the streams in the areas that were studied. However, two large reservoirs, Standley Lake and Great Western Reservoir, exist at the upstream limits of the study area and provide incidental protection even though they were not designed for flood control storage.

In addition, Ketner and Jackson Lake reservoirs exist within the study area but are primarily used for irrigation purposes and were, therefore, not considered as flood protection structures. Westminster in recent years, has passed zoning ordinances to prohibit construction within floodplains to lessen potential flood damage. Ketner reservoir has been renovated to increase its flood storage capacity, thus reducing the downstream flows and floodplains.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard bydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected a shaving special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, or 500-year floods have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk

increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Peak discharge-drainage area relationships for each flooding source studied in detail affecting Westminster, Colorado are shown in Table 1.

Since no stream gage data was available for the streams studied, a rainfall-runoff analysis was conducted on the watersheds to determine the flood discharges. This was accomplished by using the Colorado (UD&FCD) CUHP rainfall-runoff computer program to develop the storm hydrographs (Reference 6) and the U.S. Army Corps of Engineers HEC-1 flood hydrograph package computer program for the stream and reservoir routings (Reference 7). For this analysis, basin characteristics which define the size, shape and runoff characteristics of the watershed as well as rainfall amounts based on the selected recurrence intervals (obtained from the NOAA atlas of precipitation - Reference 8) are used to compute flood hydrographs for various design points in the basin. All stream and reservoir routings were accomplished using the Modified Pulse Method.

Since there was a lack of 500-year precipitation data, the 500-year frequency storm runoff values at each design point were calculated. The logarithmic values of the 10-, 50-, and 100-year peak discharges were fit to a regression line by method of least squares. The 500-year discharges were analytically extrapolated from the regression line based upon a log-normal probability relationship. For more detailed information see the final hydrologic analysis report for Big Dry Creek and Tributaries prepared by Greiner Engineering, January 1984.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. The analyses in this report reflect flooding potential based on existing land use conditions in the community as of December 1983. Map and flood elevations will be amended periodically to reflect future changes.

For all streams studied, the water-surface elevations for floods of the selected recurrence intervals were computed using the U.S. Army Corps of Engineers HEC-2 Step-backwater computer program (Reference 9).

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TABLE 1. SUMMARY OF DISCHARGES

Stream Name and Location	Drainage Area (square miles)	Peak Discharges* (cubic feet per second) 10-Year	50-Year	100-Year	500-Year **
Big Dry Creek					
Interstate 25	56.84	3830	7010	8839	16729
120th Avenue	43.54	2480	6290	8109	15849
Upstream of Confluence of Airport Creek	32.89	2060	5260	6929	13370
.8 mile downstream of Denver-Boulder Turnpike	21.46	1720	4220	5669	10659
.2 mile upstream of Confluence with Walnut Creek	19.66	1050	2270	3040	5120
Stanley Lake Outflow	16.75	145	320	675	1099
Stanley Lake Inflow	16.75	1710	3980	4930	9040
Walnut Creek					
Confluence with Big Dry Creek	10.53	800	2050	2600	5086
Colorado and Southern Railroad					
Confluence with Countryside Creek	9.79	800	1300	1700	3367
Confluence with North Branch Walnut Creek	6.87	175	400	500	902
Upstream Study Limit	5.51	150	360	430	800
Great Western Reservoir Outflow	5.0	100	260	320	***
Great Western Reservoir Inflow	5.0	1530	3210	3910	6660
City Park Channel					
Confluence with Nissen Reservoir Channel	5.68	770	1300	1500	2250
South Branch Hylands Creek					
Confluence with Big Dry Creek	3.46	1120	2390	2940	5047
Confluence with Tributary A	2.17	691	1443	1765	2987
Nissen Reservoir Channel					
Confluence with Big Dry Creek	2.67	1860	3150	3400	5600
Airport Creek					
Confluence with Big Dry Creek	2.39	550	1250	1590	2860
Confluence with North Branch Airport Creek	1.06	350	780	850	1491
Upstream Study Limit	0.43	340	690	815	1348
Ranch Creek					
Confluence with Big Dry Creek	1.98	850	1800	2200	3760
Confluence with South Branch Ranch Creek	0.69	520	975	1200	1886
Upstream Study Limit	0.11	150	265	325	490

* Discharges based on rainfall adjusted for Drainage Basin Area
** Graphically Extrapolated
*** Not Determined

TABLE 1. SUMMARY OF DISCHARGES (Cont'd)

Stream Name and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
Middle Branch Hylands Creek					
Confluence with South Branch Highlands Creek	1.27	480	1050	1280	2237
Confluence with North Branch Highlands Creek	0.71	350	730	870	1480
Upstream Study Limits	0.02	20	40	50	82
North Branch Walnut Creek					
Confluence with Walnut Creek	1.14	150	410	520	1024
Upstream Study Limit	0.62	170	410	510	960
Countryside Creek					
Confluence with Walnut Creek	1.13	300	660	840	1,479
Upstream Study Limit	0.60	235	520	620	1,090
Tanglewood Creek					
Confluence with Big Dry Creek	1.12	340	758	934	1,655
Upstream Study Limit	0.11	105	217	253	424
Tributary "B" of Little Dry Creek					
Downstream Study Limit *	0.82	420	700	850	1,200
Upstream Study Limit *	0.56	270	460	550	820
South Branch Ranch Creek					
Confluence with Ranch Creek	0.70	300	625	750	1,265
Upstream Study Limit	0.42	270	550	650	1,078
North Branch Hylands Creek					
Confluence with Middle Branch Hylands Creek	0.49	130	300	370	671
Upstream Study Limit	0.08	78	155	190	319
Brandywine Creek					
Confluence with Nissen Reservoir Channel	0.42	88	211	262	489
Middle Cotton Creek					
Confluence at Big Dry Creek	0.32	98	215	260	455
Upstream Study Limit	0.10	68	135	160	261
North Cotton Creek					
Confluence with Big Dry Creek	0.30	111	248	300	532
Upstream Study Limit	0.10	30	80	105	212

* Discharges obtained from the Urban Drainage & Flood Control District "Flood Hazard Area Delineation" Little Dry Creek, June 1978.

TABLE 1. SUMMARY OF DISCHARGES (Cont'd)

Stream Name and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
South Cotton Creek					
Confluence at Big Dry Creek	0.19	46	113	140	265
Upstream Study Limit	0.10	35	90	113	221
North City Park Creek					
Confluence with Big Dry Creek	0.14	29	85	107	230
Upstream Study Limit	0.04	19	55	65	180
South City Park Creek					
Confluence with Big Dry Creek	0.09	20	54	68	138
Upstream Study Limit	0.02	10	30	40	88

Cross sections used in the backwater analyses for all streams were obtained by aerial photogrammetry (Reference 10). The below water sections of all cross sections were obtained by field measurement. All bridges, dams and culverts were field surveyed to obtain elevation data and structual geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

Roughness factors (Manning's "n") used in the hydraulic computations for the study streams were chosen by engineering judgment and based on field observations of the flooding sources and floodplain areas. Roughness values for the main channels of the streams studied range from 0.02 to 0.065 with floodplain roughness values ranging from 0.02 to 0.10.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of ± 0.5 foot for floods of the selected recurrence intervals. The results obtained from the HEC-2 program were adjusted in the vicinity of bridges to more accurately represent actual flooding conditions. Starting water-surface elevations were based on hand calculations at control sections; obtained by the slope area method, or determined for a tributary to a major stream from the major stream at concurrent flo s.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

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All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATION

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400 feet, with a contour interval of 2 feet (Reference 10).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, and AO); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2.)

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of

floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. It should be noted that various sheet flow areas are present on many of the streams and that the 100-year floodplain has been delineated to encompass all of these additional areas. The complete filling of these sheet flow areas will increase floodflows downstream thereby increasing the 100-year flood hazard. For any channel modification or fill in the sheet flow areas, a detailed review of the improvement should be undertaken to determine the effects downstream. No floodway information was available for City Park Channel and was, therefore, not included. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated using topographic maps. The results of the floodway computations are tabulated at selected cross sections (Table 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Big Dry Creek								
A	100,600	449	4,332	2.0	5163.9	5163.9	5163.9	0.0
B	101,090	480	3,794	2.3	5164.0	5164.0	5164.1	0.1
C	101,980	700	4,471	2.0	5164.2	5164.2	5164.4	0.2
D	102,820	600	3,157	2.8	5164.5	5164.5	5164.9	0.4
E	103,610	780	1,933	4.6	5165.7	5165.7	5166.2	0.5
F	104,000	624[2]	2,519	3.5	5167.0	5167.0	5167.5	0.5
G	106,900	646[2]	2,194	4.0	5181.0	5181.0	5181.8	0.8
H	108,035	800[2]	2,791	3.2	5184.0	5184.0	5185.0	1.0
I	108,910	750/ 89[3]	2,792	3.2	5184.9	5184.9	5185.9	1.0
J	109,010	550	3,956	2.2	5189.9	5189.9	5189.9	0.0
K	110,100	250	1,817	4.9	5189.9	5189.9	5190.3	0.4
L	111,160	618[3]	2,815	3.1	5191.0	5191.0	5191.7	0.7
M	114,070	790/460[3]	2,843	3.1	5196.2	5196.2	5196.5	0.3
N	115,960	206/ 55[3]	1,266	7.0	5199.0	5199.0	5199.3	0.3
O	117,970	330	2,067	4.3	5202.6	5202.6	5203.4	0.8
P	119,680	75	809	10.9	5205.6	5205.6	5206.1	0.5
Q	120,615	103	931	9.5	5208.9	5208.9	5209.9	1.0
R	122,070	450	2,836	2.9	5215.5	5215.5	5215.7	0.2
S	123,100	70	939	8.6	5217.8	5217.8	5217.8	0.0
T	124,300	220	2,757	2.9	5218.3	5218.3	5219.0	0.8
U	125,400	91	997	8.1	5219.2	5219.2	5219.8	0.7
V	126,200	240	2,342	3.5	5220.8	5220.8	5221.4	0.6
W	126,930	91	614	13.2	5220.8	5220.8	5221.4	0.0
X	127,300	158	771	10.5	5227.0	5227.0	5227.4	0.4
Y	128,170	249	1,606	5.0	5231.3	5231.3	5232.1	0.8
Z	128,965	201	1,396	3.8	5233.0	5233.0	5234.0	1.0

1 Feet Above Mouth
2 Floodway Located Outside Corporate Limits
3 Width/Width Within Corporate Limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

BIG DRY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Big Dry Creek Cont'd								
AA	129,650	96	789	10.3	5235.1	5235.1	5235.7	0.6
AB	130,540	183	1,366	5.9	5239.0	5239.0	5239.2	0.2
AC	131,380	165	1,171	6.9	5240.6	5240.6	5240.8	0.2
AD	133,000	140	1,397	5.8	5243.4	5243.4	5243.8	0.4
AE	133,100	558	4,309	1.9	5248.1	5248.1	5248.4	0.3
AF	133,800	160	2,123	3.8	5248.3	5248.3	5248.6	0.3
AG	134,200	105	1,334	6.1	5248.3	5248.3	5248.6	0.3
AH	135,100	177	1,512	5.4	5249.3	5249.3	5250.0	0.7
AI	135,740	160	813	10.0	5251.0	5251.0	5251.2	0.2
AJ	135,930	449	4,510	1.8	5262.1	5262.1	5262.4	0.3
AK	137,170	173	2,452	2.8	5262.3	5262.3	5262.6	0.3
AL	137,910	75	878	7.9	5262.4	5262.4	5262.9	0.5
AM	139,450	234	2,660	2.6	5263.7	5263.7	5264.7	1.0
AN	140,050	195	2,326	3.0	5263.8	5263.8	5264.8	1.0
AO	142,760	76	666	10.4	5266.2	5266.2	5267.0	0.8
AP	147,240	208	1,236	4.6	5278.7	5278.7	5279.2	0.5
AQ	149,240	190	1,129	5.0	5281.9	5281.9	5282.3	0.4
AR	151,480	89	577	9.8	5289.1	5289.1	5289.1	0.0
AS	157,550	74	438	6.9	5314.4	5314.4	5315.1	0.7
AT	159,560	535	996	3.1	5320.6	5320.6	5321.6	1.0
AU	163,930	136	1,801	1.7	5357.6	5357.6	5357.6	0.0
AV	164,440	80	824	3.7	5357.7	5357.7	5357.7	0.0
AW	164,780	86	736	2.2	5358.6	5358.6	5359.6	1.0
AX	169,840	29	62	5.3	5378.3	5378.3	5378.3	0.0
AY	172,190	35	84	3.9	5394.0	5394.0	5394.0	0.0

[1] Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

BIG DRY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Walnut Creek								
A	9,050	119	312	4.8	5348.9	5348.9	5349.2	0.3
B	11,870	150	358	4.2	5367.1	5367.1	5367.3	0.2
C	13,410	82	247	4.9	5380.4	5380.4	5380.4	0.0
D	14,320	77	182	6.6	5388.8	5388.8	5389.4	0.6
E	15,120	59	231	5.2	5395.0	5395.0	5395.3	0.3
F	15,950	27	111	9.4	5402.1	5402.1	5402.6	0.5
G	17,000	39	300	3.5	5410.6	5410.6	5411.3	0.7
H	18,550	49	129	8.2	5418.0	5418.0	5418.5	0.5
I	20,100	27	119	4.2	5429.3	5429.3	5430.2	0.9
J	22,050	47	122	4.1	5441.9	5441.9	5442.8	0.9
K	23,460	14	53	8.2	5454.5	5454.5	5455.4	0.9
L	24,850	21	81	5.3	5468.9	5468.9	5469.8	0.9

[1] Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

WALNUT CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
City Park Channel								
A	900	60	406	4.4	5244.4	5244.4	5244.4	0.0
B	1,290	55	177	10.2	5246.5	5246.5	5246.5	0.0
C	1,430	81	302	6.0	5249.2	5249.2	5249.4	0.2
D	1,830	95	348	5.2	5251.5	5251.5	5252.2	0.7
E	2,340	75	255	7.1	5255.5	5255.5	5255.9	0.4
F	2,840	74	216	8.3	5263.2	5263.2	5263.2	0.0
G	3,340	75	246	7.3	5271.4	5271.4	5271.5	0.1
H	3,830	65	261	6.9	5276.0	5276.0	5277.0	1.0
I	4,220	90	389	4.6	5279.0	5279.0	5279.5	0.5
J	4,330	70	350	5.1	5279.5	5279.5	5279.9	0.4
K	4,800	94	320	5.6	5282.0	5282.0	5282.3	0.3

[1] Feet Above Confluence With Nissen Reservoir Basin

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

CITY PARK CHANNEL

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
South Branch Hylands Creek								
A	130	59	258	11.4	5280.7	5280.7	5280.7	0.0
B	640	52	285	10.3	5286.9	5286.9	5287.7	0.8
C	1,300	60	355	8.3	5293.5	5293.5	5294.0	0.5
D	1,800	63	217	8.1	5298.7	5298.7	5298.8	0.1
E	2,410	69	255	6.9	5305.0	5305.0	5305.0	0.0
F	3,270	75	257	7.4	5316.7	5316.7	5317.5	0.8
G	4,000	86	229	7.7	5327.4	5327.4	5327.4	0.0
H	4,600	88	246	7.2	5334.9	5334.9	5335.2	0.3
I	4,820	284	656	2.7	5349.3	5349.3	5349.3	0.0
J	5,300	309	696	2.5	5350.2	5350.2	5350.2	0.0
K	5,450	775	2,652	0.7	5358.4	5358.4	5358.4	0.0
L	6,040	138	235	7.5	5361.8	5361.8	5361.8	0.0
M	6,550	75	299	5.9	5366.5	5366.5	5366.5	0.0

[1] Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

SOUTH BRANCH HYLANDS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Nissen Reservoir Channel								
A	310	151	476	8.0	5213.7	5213.7	5214.3	0.6
B	500	227	508	7.5	5231.1	5231.1	5231.5	0.4
C	880	503	3,132	1.2	5231.8	5231.8	5232.8	1.0
D	1,260	280	570	6.7	5232.3	5232.3	5232.5	0.2
E	1,650	175	961	4.0	5234.4	5234.4	5234.5	0.1
F	2,250	131	603	6.3	5235.6	5235.6	5235.9	0.3
G	2,300	96	357	10.6	5235.6	5235.6	5236.0	0.4

[1] Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

NISSEN RESERVOIR CHANNEL

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Airport Creek								
A	490	126	350	4.5	5262.3	5254.5[2]	5254.0	0.0
B	960	93	195	8.2	5262.3	5261.8[2]	5262.1	0.3
C	2,070	73	371	4.3	5278.6	5278.6	5278.6	0.0
D	2,900	57	216	6.9	5280.9	5280.9	5281.6	0.7
E	4,800	69	161	8.8	5297.8	5297.8	5297.8	0.0
F	5,575	62	201	7.1	5306.6	5306.6	5306.6	0.0
G	5,760	110	697	2.0	5312.8	5312.8	5312.8	0.0
H	6,570	60	178	8.0	5316.8	5316.8	5316.8	0.0
I	7,300	55	155	8.6	5325.7	5325.7	5325.7	0.0

[1] Feet Above Mouth
[2] Elevations Computed Without Consideration Of Backwater From Big Dry Creek

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

AIRPORT CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Ranch Creek								
A	300	281	1,012	2.2	5208.8	5207.2[2]	5208.2[2]	1.0
B	1,000	60	260	8.5	5219.2	5219.2	5220.2	1.0
C	1,390	85	268	8.2	5226.7	5226.7	5226.7	0.0
D	1,470	85	375	5.9	5227.8	5227.8	5228.0	0.2
E	1,620	100	977	2.3	5237.4	5237.4	5237.4	0.0
F	2,200	110	513	4.3	5238.7	5238.7	5239.0	0.3
G	2,500	236	2,354	0.9	5249.4	5249.4	5249.8	0.4
H	3,230	96	567	3.5	5250.0	5250.0	5250.4	0.4
I	3,760	41	231	8.7	5253.5	5253.5	5254.1	0.6
J	4,670	249	300	6.7	5293.3	5293.3	5293.3	0.0
K	4,710	645	495	4.0	5301.0	5301.0	5301.1	0.1
L	4,750	680	8,528	0.2	5301.3	5301.3	5301.3	0.0
M	5,380	370	2,532	0.5	5301.3	5301.3	5301.3	0.0
N	6,290	111	345	3.0	5301.4	5301.4	5301.4	0.0
O	6,480	94	166	6.3	5304.1	5304.1	5304.5	0.4
P	7,160	52	116	7.7	5315.0	5315.0	5315.5	0.5
Q	7,220	120	145	6.2	5321.3	5321.3	5321.5	0.2
R	7,850	40	109	7.3	5324.8	5324.8	5325.2	0.4
S	8,130	92	403	2.0	5333.1	5333.1	5333.1	0.0
T	8,300	130	534	1.5	5333.3	5333.3	5333.3	0.0
U	8,900	70	95	6.3	5341.9	5341.9	5341.9	0.0
V	9,700	45	105	4.4	5360.2	5360.2	5360.6	0.4
W	10,520	47	53	6.1	5377.0	5377.0	5377.0	0.0
X	10,950	36	49	6.6	5389.6	5389.6	5390.3	0.7

[1] Feet Above Mouth
[2] Elevations Computed Without Consideration Of Backwater From Big Dry Creek

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

RANCH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE[3]
Middle Branch Hylands Creek								
A	230	78	266	4.8	5298.1	5298.1	5298.1	0.0
B	780	55	252	5.1	5300.8	5300.8	5300.8	0.0
C	1,300	41	131	9.8	5309.4	5309.4	5309.4	0.0
D	1,760	65	189	4.6	5316.1	5316.1	5316.1	0.0
E	2,000	48	125	6.8	5321.3	5321.3	5321.3	0.0
F	2,630	25	107	7.9	5333.0	5333.0	5333.0	0.0
G	3,480	37	118	5.9	5350.6	5350.6	5350.6	0.0
H	3,980	42	86	8.2	5363.7	5363.7	5363.7	0.0
I	4,700	56	141	4.2	5374.0	5374.0	5374.0	0.0
J	5,200	36	90	6.5	5381.2	5381.2	5381.2	0.0
K	5,365	42	107	4.9	5386.8	5386.8	5386.8	0.0
L	5,790	47	81	6.5	5396.1	5396.1	5396.1	0.0
M	6,200	29	74	6.1	5406.0	5406.0	5406.0	0.0
N	6,320	45	193	2.3	5410.5	5410.5	5410.5	0.0
O	6,670	105	265	1.7	5411.0	5411.0	5411.1	0.1
P	7,090	120	725	0.6	5419.4	5419.4	5419.4	0.0
Q	7,340	56	103	3.2	5419.7	5419.7	5419.7	0.0
R	7,500	42	107	2.2	5431.4	5431.4	5431.4	0.0
S	7,800	69	50	4.8	5441.4	5441.4	5441.4	0.0
T	8,080	64	85	2.8	5443.6	5443.6	5443.6	0.0
U	8,160	76	60	4.7	5444.9	5444.9	5444.9	0.0
V	8,590	23	41	5.9	5451.5	5451.5	5451.5	0.0
W	8,700	20	32	7.4	5456.5	5456.5	5456.5	0.0
X	9,070	17	31	6.7	5463.6	5463.6	5463.6	0.0
Y	9,440	24	32	6.6	5477.3	5477.3	5477.3	0.0

1Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.

(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

MIDDLE BRANCH HYLANDS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE[3]
Middle Branch Hylands Creek (Cont'd)								
Z	9,620	106	68	2.6	5483.6	5483.6	5483.6	0.0
AA	9,790	98	124	1.2	5489.5	5489.5	5489.5	0.0
AB	10,450	26	20	4.5	5505.2	5505.2	5505.2	0.0
AC	10,900	30	13	3.8	5526.3	5526.3	5526.3	0.0

1Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.

(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

MIDDLE BRANCH HYLANDS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
North Branch Walnut Creek								
A	360	40	79	6.6	5434.9	5434.9	5435.5	0.6
B	1,790	29	98	5.3	5450.0	5450.0	5450.8	0.8
C	3,320	22	69	7.5	5466.5	5466.5	5467.2	0.7

1 Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

NORTH BRANCH WALNUT CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Countryside Creek								
A	140	20	124	68	5350.1	5350.1	5350.1	0.0
B	510	53	123	6.8	5353.0	5353.0	5353.0	0.0
C	1,800	104	335	2.5	5361.0	5361.0	5361.0	0.0
D	2,745	30	104	7.2	5369.6	5369.6	5369.6	0.0
E	4,310	56	136	5.5	5390.3	5390.3	5390.3	0.0
F	4,860	51	92	7.2	5400.6	5400.6	5400.9	0.3
G	5,590	141	196	3.4	5409.9	5409.9	5410.0	0.1
H	6,510	202	191	3.5	5420.5	5420.5	5420.5	0.0
I	7,340	48	128	4.9	5428.5	5428.5	5428.5	0.0

1Feet Above Mouth

BEST COPY AVAILABLE

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.

(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

COUNTRYSIDE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Tanglewood Creek								
A	1,450	73	568	1.6	5182.6	5182.6	5182.7	0.1
B	2,550	72	154	4.9	5191.6	5191.6	5192.4	0.8
C	3,720	65/0.0[2]	125	5.3	5210.1	5210.1	5210.2	0.1
D	4,860	65	87	6.6	5229.5	5229.5	5229.5	0.0
E	5,720	45	84	6.1	5246.5	5246.5	5246.5	0.0
F	6,240	52	79	6.5	5256.3	5256.3	5256.4	0.1
G	6,620	256	1,720	0.3	5274.3	5274.3	5274.3	0.0
H	7,380	75	77	5.1	5280.9	5280.9	5280.9	0.0
I	8,120	34	49	6.9	5301.5	5301.5	5301.5	0.0
J	8,600	132	60	5.6	5320.3	5320.3	5320.3	0.0
K	8,760	184	317	0.9	5321.0	5321.0	5321.0	0.0
L	9,280	78	53	4.7	5331.6	5331.6	5331.6	0.0
M	9,770	64	53	4.8	5339.8	5339.8	5339.8	0.0

1 Feet Above Mouth
2 Width/Width Within Corporate Limits

BEST COPY AVAILABLE

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

TANGLEWOOD CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
Tributary "B" to Little Dry Creek								
A	1,330	139	502	1.7	5455.5	5455.5	5456.5	1.0
B	1,520	46	114	7.5	5455.8	5455.8	5456.2	0.4
C	1,600	44	106	8.0	5456.1	5456.1	5456.3	0.2
D	1,690	77	348	2.4	5460.0	5460.0	5460.7	0.7
E	2,285	53	137	5.1	5462.4	5462.4	5462.4	0.0
F	2,600	65	165	4.2	5465.7	5465.7	5465.7	0.0
G	2,795	126	700	1.0	5471.1	5471.1	5471.1	0.0
H	3,385	50	102	5.4	5474.6	5474.6	5474.6	0.0
I	4,075	63	134	4.1	5481.1	5481.1	5481.1	0.0

BEST COPY AVAILABLE

[1] Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

TRIBUTARY B TO LITTLE DRY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
South Branch Ranch Creek								
A	660	339	271	2.3	5316.9	5316.9	5316.9	0.0
B	1,000	257	2,085	0.3	5317.0	5317.0	5317.0	0.0
C	1,390	91	306	2.0	5317.0	5317.0	5317.0	0.0
D	1,830	74	110	5.7	5321.7	5321.7	5321.7	0.0
E	2,340	35	68	8.0	5338.9	5338.9	5338.9	0.0
F	2,970	55	93	5.9	5354.6	5354.6	5354.6	0.0

[1] Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

SOUTH BRANCH RANCH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
North Branch Hylands Creek								
A	220	57	63	5.9	5324.1	5324.1	5324.1	0.0
B	850	65	111	3.3	5336.7	5336.7	5336.8	0.1
C	1,770	27	64	5.0	5350.8	5350.8	5350.8	0.0
D	2,400	43	56	5.7	5365.4	5365.4	5365.4	0.0
E	3,000	55	74	3.7	5378.7	5378.7	5378.7	0.0
F	3,600	43	52	5.2	5392.2	5392.2	5392.2	0.0
G	3,770	357	258	1.0	5409.4	5409.4	5409.4	0.0
H	4,270	80	133	1.7	5410.7	5410.7	5410.7	0.0
I	4,725	97	118	1.9	5421.4	5421.4	5421.4	0.0
J	5,000	53	103	2.2	5422.4	5422.4	5422.4	0.0
K	5,170	49	56	4.1	5424.3	5424.3	5424.5	0.2
L	5,350	96	112	1.7	5436.3	5436.3	5436.3	0.0
M	6,170	19	41	4.6	5455.3	5455.3	5456.2	0.9

[1] Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

NORTH BRANCH HYLANDS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE[3]
					(FEET NGVD)			
South City Park Creek								
A	100	95	35	1.7	5273.4	5273.4	5273.5	0.1
B	850	20	15	3.6	5291.8	5291.8	5291.9	0.1
C	1,400	38	14	2.8	5308.3	5308.3	5308.3	0.0
D	2,000	46	13	3.0	5330.0	5330.0	5330.0	0.0

[1] Feet Above Mouth

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WESTMINSTER CO.
(ADAMS AND JEFFERSON CO'S.)

FLOODWAY DATA

SOUTH CITY PARK CREEK

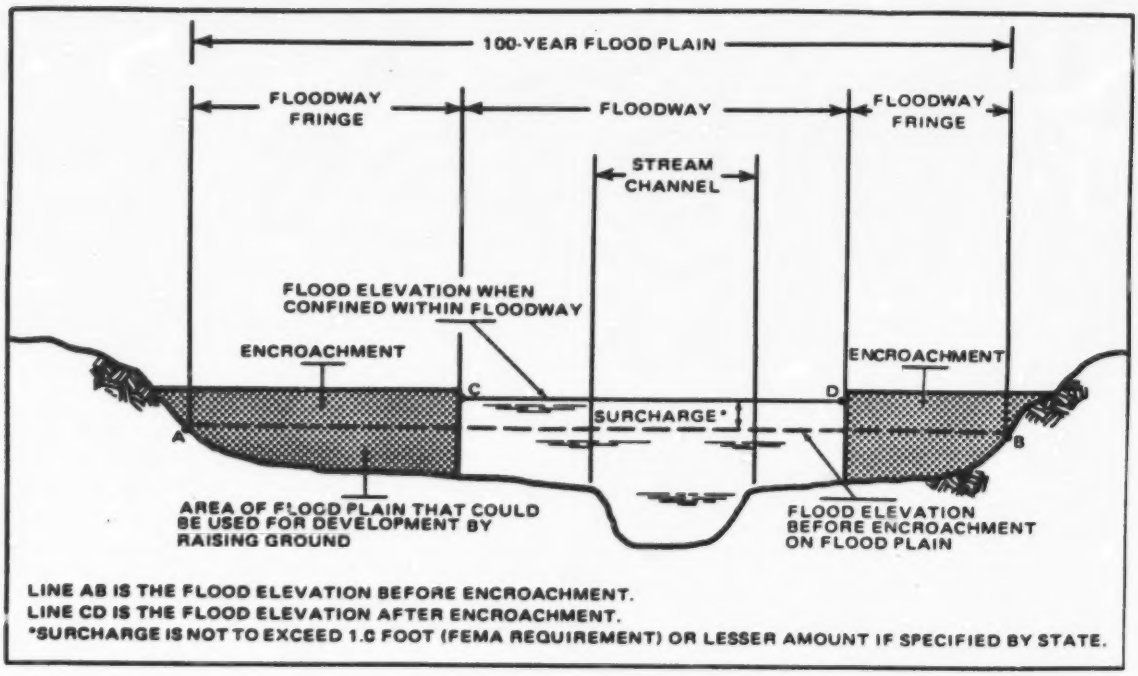
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

Previous studies for Westminster include a Floodplain Information Report prepared for the Denver Regional Council of Governments by the U.S. Army Corps of Engineers, Omaha, Nebraska. This report covered part of Little Dry Creek and Little Dry Creek First Tributary. The study was completed in October of 1968 (Reference 11).

A Flood Insurance Study for the City of Westminster was prepared by the Bureau of Reclamation, in October of 1977, and was used as a guide for preparing the text for this report. The 1977 Flood Insurance Study was never published by the Federal Emergency Management Agency (Reference 12).

A Master Plan for Big Dry Creek was prepared by Wright-McLaughlin Engineers, in March of 1973, for the Urban Drainage and Flood Control District. This study covered Big Dry Creek in Adams and Jefferson Counties (Reference 3).

A Flood Hazard Boundary Map was compiled and published by the Department of Housing and Urban Development, April 23, 1976 (Reference 13). Because of the more detailed and current nature of this hydrologic analysis, this Flood Insurance Study supersedes the data presented on the Flood Hazard Boundary Map.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

1. Colorado Urban Drainage and Flood Control District, Flood Hazard Area Delineation-Broomfield Area, June 1979.

2. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study City of Broomfield, Adams, Boulder and Jefferson Counties, Colorado, Unpublished.

3. Colorado Urban Drainage and Flood Control District, Master Plan - Major Drainageway Planning City of Westminster, Colorado, Adams & Jefferson County, Volumes I and II, November, 1973.

4. Colorado Urban Drainage and Flood Control District, Flood Hazard Area Delineation Arvoda and Westminster Area, Jefferson County, June 1978 (Little Dry Creek revised by Greiner Engineer Sciences, Inc., May 1986).

5. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population and Housing, March 1981.

6. Colorado Urban Drainage and Flood Control District, CUHP Computer Program, June 1983.

7. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Generalized Computer Program, Davis, California, November 1981.

8. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Atlas 2, Precipitation - Frequency Atlas of the Western United States, Volume III - Colorado, 1973.

9. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-surface Profiles Generalized Computer Program, Davis, California, 1976.

10. Delta Aerial Surveys, Inc., Topographic and Planimetric Maps, Scale 1:2,400, Contour Interval 2 feet, 1976.

11. Denver Regional Council of Governments, "Floodplain Information; Big Dry Creek, Little Dry Creek (Arapahoe County), Greenwood Gulch, Weir Gulch, Lakewood Gulch, South Lakewood Gulch, McIntyre Gulch, Little Dry Creek (Adams County), Grange Hall Creek - Volume IV - Denver Metropolitan Region, Colorado", prepared by U.S. Army Corps of Engineers, Omaha, Nebraska, October, 1968.

12. U.S. Department of the Interior, Bureau of Reclamation, Lower Missouri Region, Flood Insurance Study, City of Westminster, Denver, Colorado, October, 1977.

13. Federal Emergency Management Agency, Federal Insurance Administration, Flood Hazard Boundary Map, City of Westminster, Adams and Jefferson Counties, Colorado, April 23, 1976.